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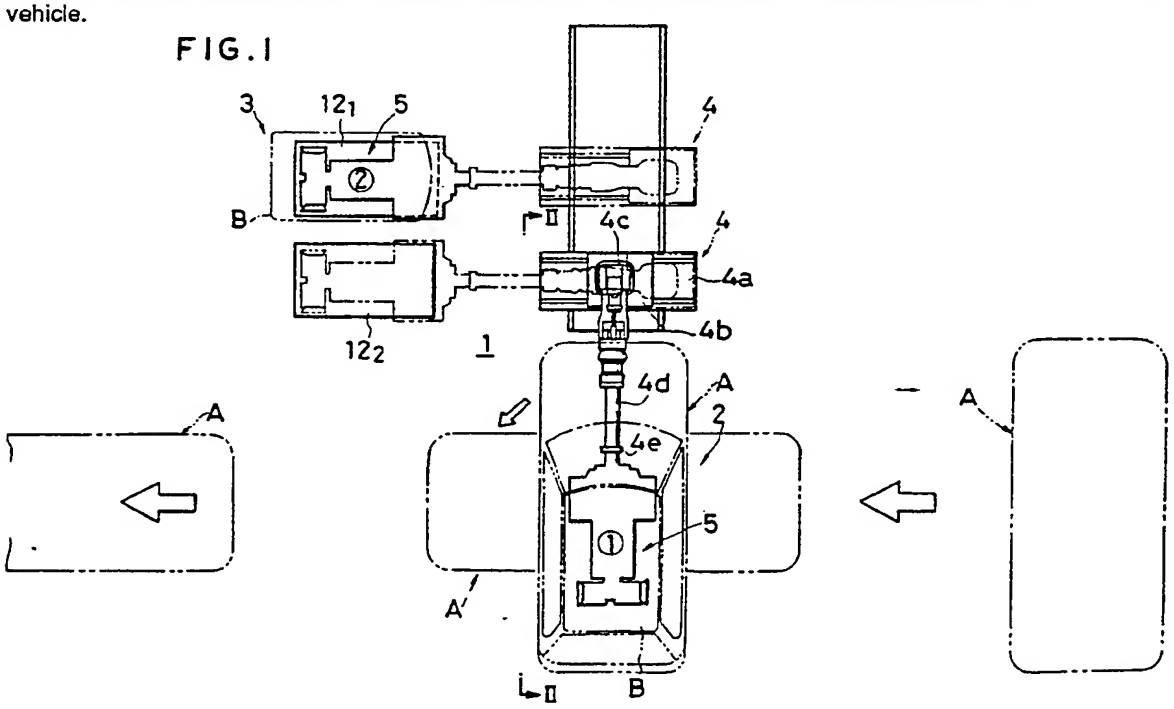
(54) **Automatic assembling apparatus**

(57) A plurality of identical assembling jigs (5), on which are set a plurality of vehicle parts (e.g. a rear view mirror or an interior lamp), are attached in turn to a robot arm (4d) for movement by operation of a robot (4) from a setting site (3) to an assembling site (2) (e.g. in the interior of a vehicle cabin). The use of more than one assembling jig permits a second jig to be set up with parts at the setting station whilst a first jig is in use at the assembling site where the parts are assembled on the vehicle.

FIG.1



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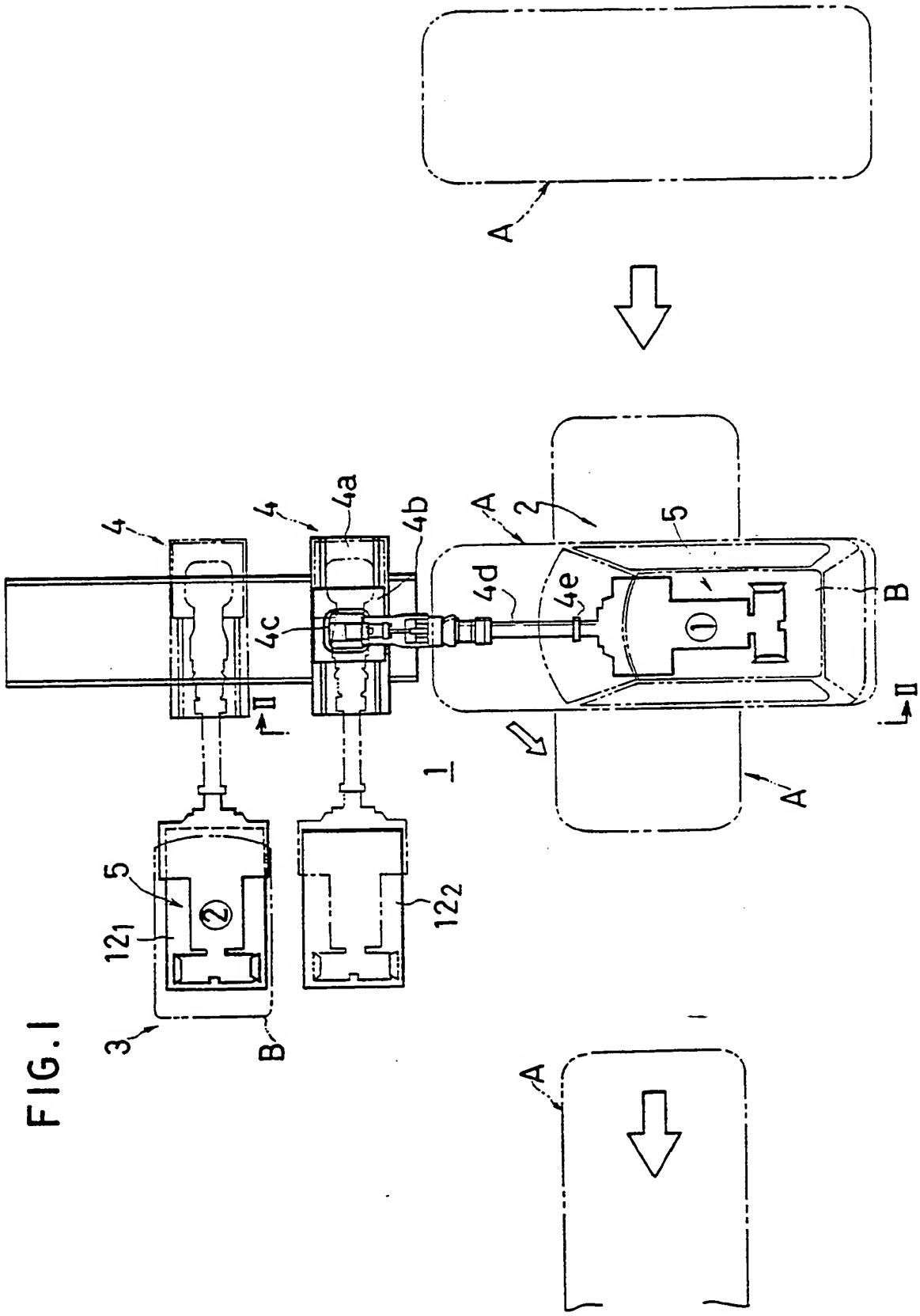
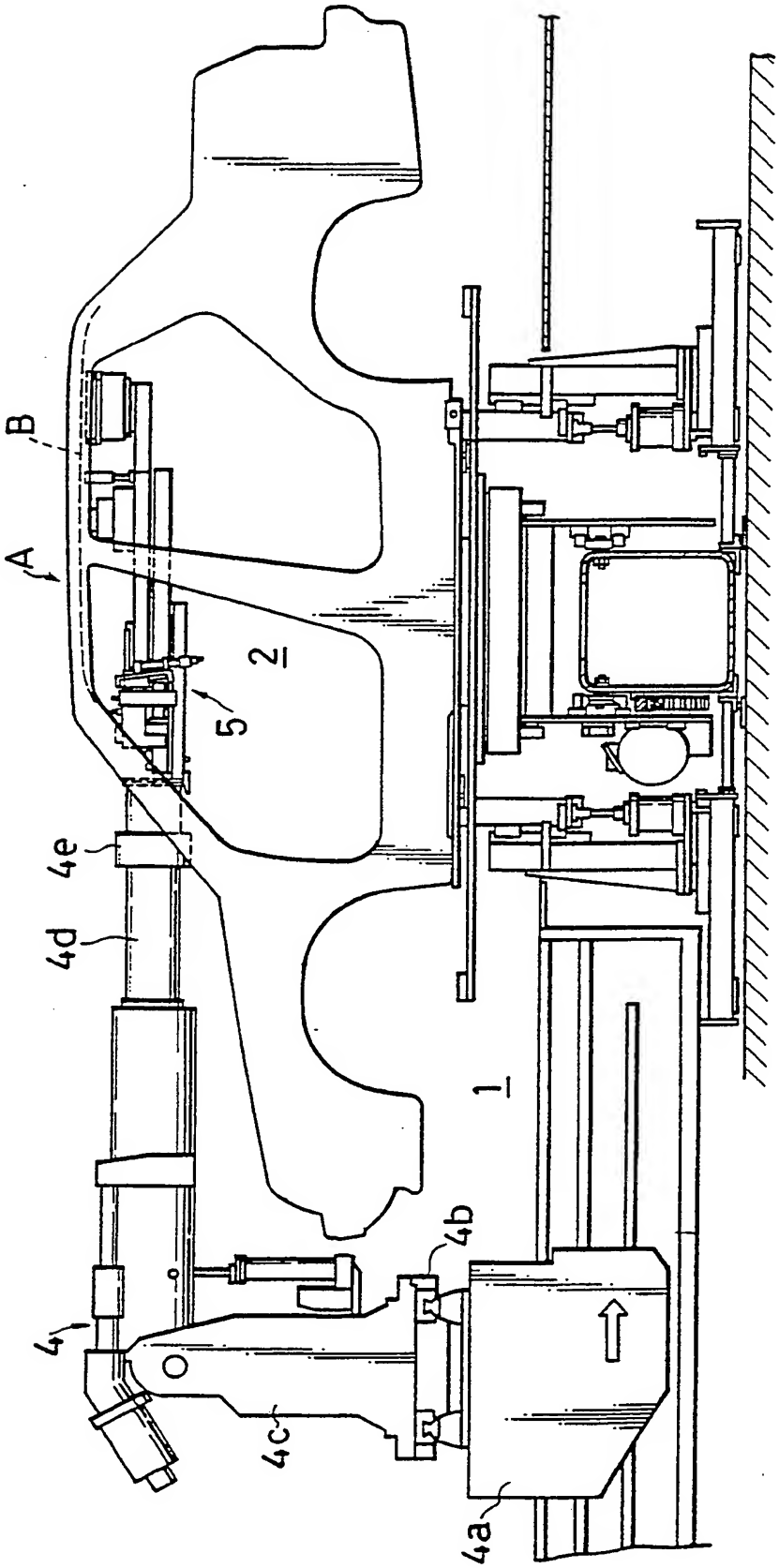


FIG.1

FIG.2



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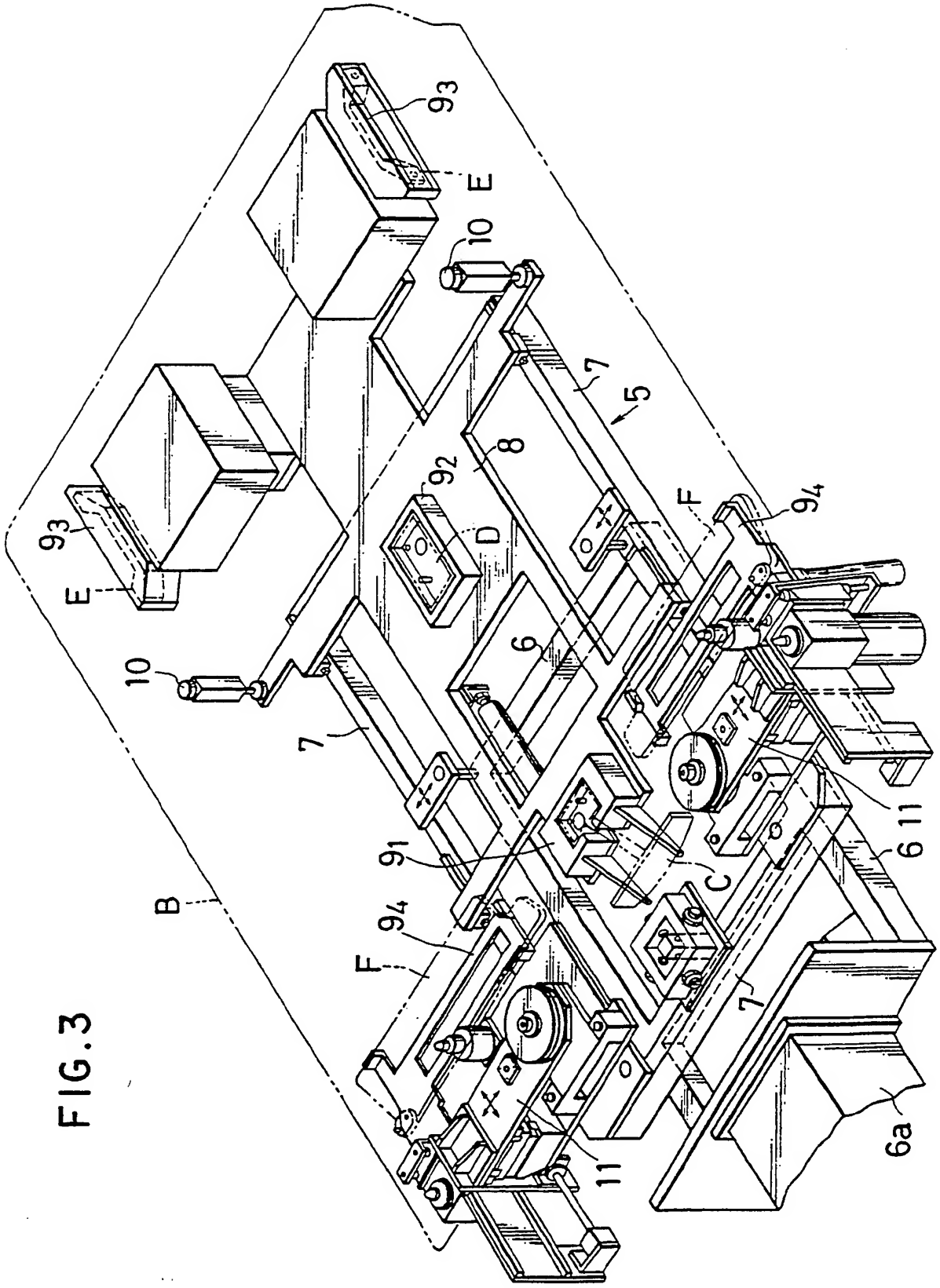

FIG.3

AUTOMATIC ASSEMBLING APPARATUS

This invention relates to an automatic assembling apparatus for assembling a plurality of parts to an article.

The applicant of this patent application has previously proposed in Japanese Patent Application No. 1987-99298 an assembling apparatus for assembling a plurality of automobile parts such as a roof lining, a mirror, a lamp, etc. to a car body, wherein an assembling jig carrying these parts is connected to an arm of a robot, and the assembling jig is then moved by operation of the robot from a setting site to an assembling site and is inserted into the cabin of the car body placed at the assembling site to assemble these parts set in advance on the assembling jig to the cabin roof portion of the car body.

Generally in an automatic assembling apparatus, it is usual that these parts are set on a setting jig placed at a setting site while the assembling work is being performed at an assembling site, and when an assembling jig is returned to the setting site those parts set on the setting jig are transferred onto said assembling jig. In such an assembling apparatus as the above-mentioned one for assembling parts to the cabin roof portion, however, it is necessary to set small parts such as a mirror, a lamp, etc. below a roof lining or another larger-sized part. It is, therefore, difficult to have the setting jig hold the small-sized parts in place because of the obstruction caused by the roof lining or larger-sized part.

In the apparatus proposed by the above-mentioned previous patent application, therefore, it is so arranged that the small parts and the roof lining to be placed above them are set directly on the assembling jig when it is returned to the setting site. In this arrangement, however, the time required to carry out

the setting operation constitutes a time loss which is detrimental to productivity.

In view of the foregoing, the present invention seeks to provide an automatic assembling apparatus that enables the assembling work to be performed efficiently without said time loss resulting from the setting operation even when no setting jig is used.

According to the present invention there is provided an automatic assembling apparatus in which an assembling jig is attached to a robot arm and the assembling jig is then moved by operation of a robot from a setting site to an assembling site for assembling a plurality of parts set thereon at the setting site to an article placed at the assembling site, said apparatus having at least two identical assembling jig units, said two units being alternately attached to the robot arm at the setting site.

While one assembling jig connected to the robot arm is moved to the assembling site and the assembling work using said one assembling jig is being performed there, a plurality of parts are set on the other assembling jig remaining at the setting site. When said one assembling jig is returned to the setting site after completing the assembling work at the assembling site, the robot arm is disconnected therefrom and is connected to the other assembling jig at the setting site.

For a better understanding of the present invention, and to show how it may be carried into effect, reference will now be made, by way of example, to the accompanying drawings in which:

Figure 1 is an overall top plan view of an automatic assembling apparatus according to one embodiment of the present invention;

Figure 2 is a side view thereof taken along the line II-II in Figure 1; and

Figure 3 is a perspective view of the assembling jig.

Referring to Figure 1, reference numeral 1 denotes an assembling station provided on an automobile assembly line. The car body A is placed at a predetermined assembling site 2 in the assembling station 1 in such a way that its lengthwise direction may be perpendicular to the longitudinal direction of the assembly line. A robot 4 is operated to move an assembling jig 5 from a setting site 3 located at one side of the assembling site 2 to the assembling site 2 and, as shown in Figure 2, the assembling jig 5 is inserted into the cabin through the front window of the car body A to assemble to the cabin roof portion a plurality of interior parts such as the roof lining etc.

The robot 4 comprises a first slide table 4a that is movable back and forth in the lengthwise direction of the car body A, a second slide table 4b which is mounted on the first slide table 4a and is movable back and forth in the width wise direction of the car body A, a robot body 4c which is mounted on the second slide table 4b and is turnable about the vertical axis line thereof, and a robot arm 4d which is attached to the robot body 4c and is vertically swingable. The assembling jig 5 is detachably connected to the front end of the robot arm through a chuck member 4e.

As shown in Figure 3, the assembling jig 5 comprises a base frame 6 having a front-end arm 6a clamped by the chuck member 4e, a floating frame 7, a jig frame 8 mounted on the base frame 6 through the floating frame 7, setting units 9_1, 9_2 and 9_3 for a rear view mirror C, an interior light D and a grab rail E respectively and a pair of receiving seats 10 for a roof lining B, all of which are provided on the jig frame 8, and a setting unit 9_4 for a sun visor F, said

setting unit 9_4 being provided on the floating frame 7 through a floating sub-frame 11. Using nut runners (not shown) provided on these setting units 9_1 to 9_4, a roof lining B and small parts such as an interior light D, etc. are concurrently fastened to the roof portion of the car cabin.

Two similar assembling jig units 5 are included in the apparatus. Further, first and second receiving tables 12_1, 12_2, each of which mount thereon an assembling jig 5, are provided alongside each other in the setting site 3, so that the assembling jig 5 can be transferred by an appropriate transfer means (not shown) from the second receiving table 12_2 located closer to the assembling site 2 to the first receiving table 12_1 located further out.

Now, the operating steps according to the above embodiment will be explained.

While a first assembling jig indicated by ① in Figure 1 is moved to the assembling site 2 and the assembling work is going on there the setting units 9_1 to 9_4 on a second assembling jig 5 placed on the first receiving table 12_1 and indicated by ② are loaded with a rear view mirror C, an interior light D, a grab rail E and a sun visor F, respectively, and a roof lining B is set above them.

After completion of the above assembling work, the robot 4 is operated to return said first assembling jig ① from the assembling site 2 to the setting site 3 and mount said jig onto said second receiving table 12_2. Next, the chuck means 4e is opened to release the assembling jig ① from the robot arm 4d and thereafter the robot arm 4d is moved to the first receiving table 12_1 to clamp the second assembling jig ② by means of the chuck member 4e.

In the meantime, the car body A for which the above assembling work has been completed is turned to

have its lengthwise axis aligned with the longitudinal direction of the assembly line and is then conveyed out of the assembling station 1. Thereafter, another car body A is brought into the station to be stopped and set in position at the assembling site 2.

Next, the second assembling jig ② is lifted up from the first receiving table 12_1 and moved to the assembling site 2 for assembling a roof lining B and other small parts such as a rear view mirror C, etc. set thereon to the cabin ceiling portion of the car body A. Then the first assembling jig ① is transferred onto the first receiving table 12_1 to have a roof lining B and other small parts such as a rear view mirror C, etc. set thereon.

The foregoing operations are repeated to attach the first and second assembling jigs ① and ② alternatively to the robot arm 4d and continuously perform the above-described assembling work.

It is possible to set the above parts on an assembling jig 5 without relocating the jig from the second receiving table 12_2 to the first receiving table 12_1. However, performing said setting work according to the above embodiment of the present invention is more advantageous in that it enables an assembly worker to perform the setting work at a single location and thus reduces his workload.

As described in the foregoing, according to the present invention, while one assembling jig is moved to the assembling site and the assembling work is being performed there, the setting work to set the above parts on the other assembling jig remaining at the setting site is carried out, so that the next round of assembling work can be readily started simply by changing over the connection of the robot arm from one assembling jig to the other one when the assembling work using said one assembling jig has been completed.

This enables the assembly work to be performed continuously and efficiently without time loss that could otherwise result from the setting work even when no setting jig is used.

CLAIMS

1. An automatic assembling apparatus in which an assembling jig is attached to a robot arm and the assembling jig is then moved by operation of a robot from a setting site to an assembling site for assembling a plurality of parts set thereon at the setting site to an article placed at the assembling site, and in which at least two identical assembling jig units are provided, said ~~two~~ units being alternately attached to the robot arm at the setting site.

2. An automatic assembling apparatus as claimed in claim 1, wherein two receiving tables, each of which can have an assembling jig mounted thereon, are provided alongside each other at the setting site, a transfer means being provided to transfer an assembling jig from one receiving table to the other receiving table, and wherein the assembling jig attached to the robot arm is detached from the robot arm and placed on said one receiving table and the other assembling jig mounted on the other receiving table is then attached to the robot arm.

3. An automatic assembling apparatus as claimed in any one of the preceding claims, wherein the article is a car body, the plurality of parts include a roof lining and small parts such as a mirror, a lamp, etc., which are to be assembled to the cabin roof portion of the car body, and the assembling jig is so arranged that these small parts and the roof lining are set thereon in such a way that the roof lining is placed above the small parts.

4. An automatic assembling apparatus substantially as described herein with reference to, and as shown in, the accompanying drawing.

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